

REMARKS

Claims 1-8 are pending. By this Response, claim 4 has been amended. No new matter has been added. Reconsideration and allowance are respectfully requested in view of the above amendments and following remarks.

Claim Rejections -35 USC 103

A. Claims 1-3

Claims 1-3 stand rejected under 35 USC 103(a) in view of Yamada, Cheng and Klein. This rejection is respectfully traversed.

According to the present invention as recited in claim 1, a producing method of a semiconductor device includes: film thinning a silicon oxide film by heating the silicon oxide film formed after a surface of a silicon substrate is etched by chemical liquid; and one of thermal oxidizing by heating the thinned silicon oxide film to oxidize the silicon oxide film by gas including at least oxygen, and plasma oxidizing the thinned silicon oxide film by plasma discharged gas including at least oxygen.

With this process, it is possible to form a high quality oxide film having small leak current (see paragraph [0034] of the specification, for example).

The examiner asserts that Yamada discloses a producing method of a semiconductor device, comprising: forming a silicon oxide film after a surface of a silicon substrate is etched (see paragraph [0049] of Yamada); and film thinning a silicon oxide film by heating (see paragraphs [0050] and [0051] of Yamada). Applicants respectfully disagree.

Applicants submit that Yamada discloses a manufacturing method of a semiconductor integrated circuit device (see paragraphs [0049] - [0051]).

Paragraph [0049] of Yamada states that a thin silicon oxide film is formed on a silicon substrate; next, a silicon nitride film is deposited on the silicon oxide film by CVD (Chemical Vapor Deposition); after that, the silicon nitride film and the silicon oxide film are removed by dry etching.

Paragraphs [0050] and [0051] of Yamada state that a thin silicon oxide film is formed on an inner wall of a trench by thermal treatment in order to remove the damaged layer on the inner wall of the trench, after the etching recited in paragraph [0049]; next, a silicon oxide film is deposited on the substrate by CVD.

Accordingly, the thin silicon oxide recited in paragraph [0049] is different from the thin silicon oxide recited in paragraphs [0050] and [0051].

With respect to the thin silicon oxide recited in paragraph [0049], Yamada fails to disclose that a silicon oxide film is formed after a surface of a silicon substrate is etched by chemical liquid, and the silicon oxide film is heated to thin the film.

With respect to the thin silicon oxide recited in paragraphs [0050] and [0051] of Yamada, a thin silicon oxide film is merely formed by thermal treatment. That is, Yamada fails to disclose that a silicon oxide film is formed after a surface of a silicon substrate is etched by chemical liquid, and the silicon oxide film is heated to thin the film.

The examiner also asserts that Klein teaches a silicon oxide etched by chemical liquid (Klein; Column 4, lines 9-11). Klein, however, merely

discloses that trenches 17 are anisotropically etched with a plasma reactor, and does not disclose nor suggest that a surface of a silicon substrate is etched by chemical liquid to form a silicon oxide film. Accordingly, a high quality thin oxide film cannot be formed.

Therefore, the claimed invention would not be attained by the combination of Yamada, Cheung and Klein. Accordingly, withdrawal of the rejection is respectfully requested.

B. Claims 4-7

Claims 4-7 stand rejected under 35 USC 103(a) in view of Yamada, Cheng, Klein and Tokai. This rejection is respectfully traversed.

According to the present invention as recited in claim 4, in the film thinning, the silicon oxide film formed after the etching is carried out is processed under a reduced pressure in nitrogen atmosphere.

Tokai teaches that a silicon oxide film is processed under a reduced pressure (Tokai; Column 2, lines 43-57). A specific example of a treatment method for forming an oxide film on a Si wafer is disclosed in column 10, line 37 to column 11, line 7. In this example, mixed gases of oxygen gas and nitrogen gas are supplied into a chamber under the reduced pressure (see Tokai; column 10, lines 65-67). However, if oxygen gas is supplied into a chamber under the reduced pressure, an oxide film obviously becomes thicker, and thus a thin film cannot be formed.

Therefore, it is impossible to combine Yamada's teachings with those of Tokai. Thus, the combination of Yamada and Tokai fail to teach each and every feature of claim 4 as required. Claims 5-7 are likewise distinguished

for the reasons set forth above as well as for the additional features they recite. Accordingly, withdrawal of the rejection is respectfully requested.

Conclusion

In view of the foregoing, it is respectfully submitted that claims 1-8 are patentable over the cited references. Prompt allowance is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Chad J. Billings Reg. No. 48,917 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Dated: **August 14, 2009**

Respectfully submitted,

By 

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